NASA RAP/P2 Workshop – Kennedy Space Center
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Life Cycle Assessment (LCA) and Environmentally Preferred Products Plus (EPP+)

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GRC Policy
Environmental Program Manual
Chapter 9

GRC employees and contractors

will use life cycle assessments

- in project design phases

- and for procurement decisions

…to the extent feasible and practical

Implementing Life Cycle Assessment at GRC: A Three-Tiered Approach

Life Cycle Assessment (LCA)

Environmentally Preferred Purchasing (EPP)

Sustainable Design

EMS / Pollution Prevention / Sustainable Activities / GtG

Sustainable Design and Development

Life-cycle approach to facilities planning, design, construction, operation and maintenance

Life Cycle Assessments

Comprehensive project examination of economic, E H & S impacts throughout lifetime

Environmentally Preferred Products Plus

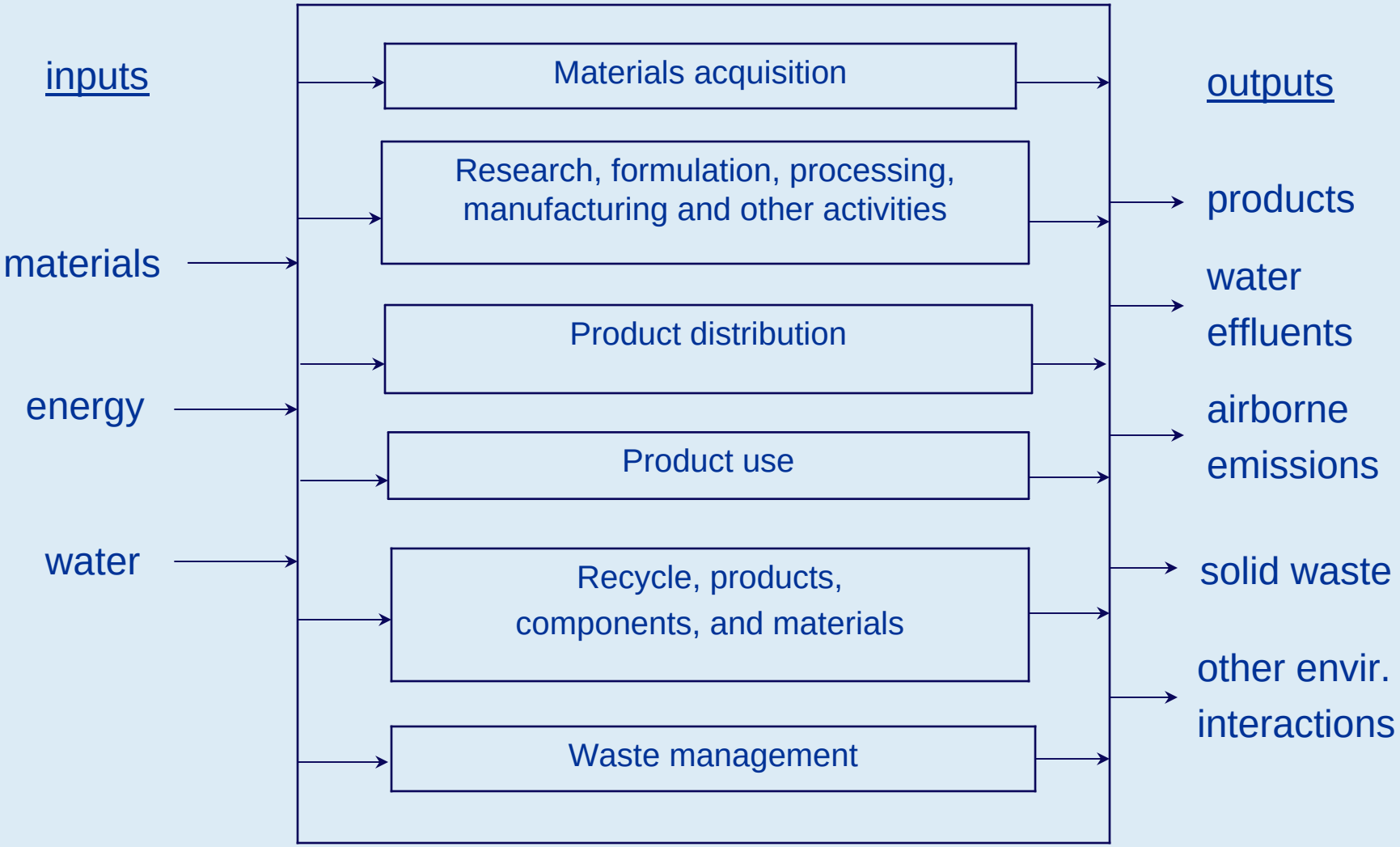
Life-cycle approach to evaluating off-the-shelf products for multiple applications

Affirmative Procurement

Encourage purchase of products with recycling/biobased content

Regulatory Compliance

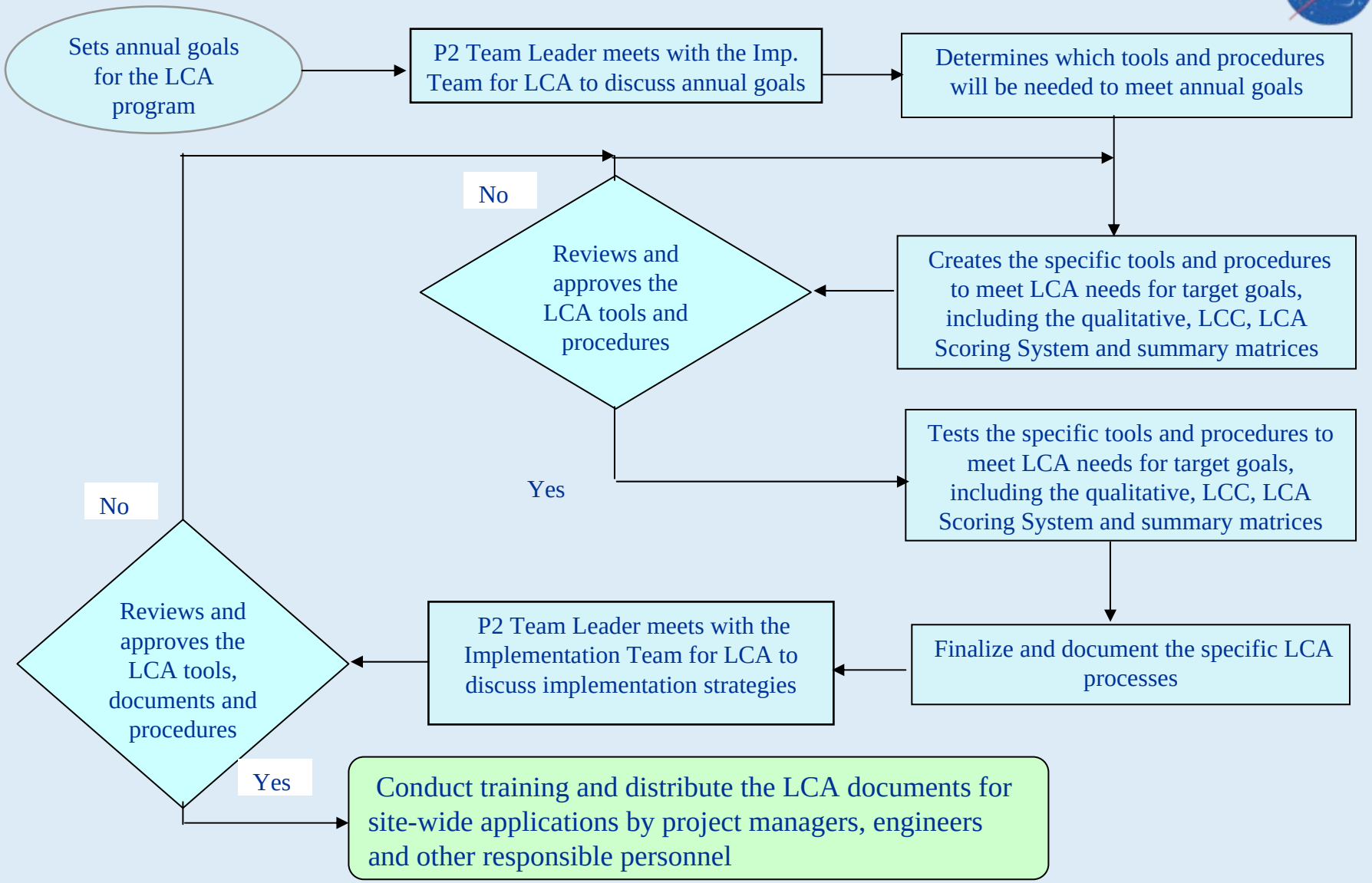
Life Cycle Based Evaluation Concept



Life-Cycle Assessment Tools

- Qualitative LCA Assessment matrix
- Quantitative Life Cycle Costing (LCC)
- Mixed qualitative / quantitative LCA Scoring System matrix (EPP+)
- LCA Summary matrix

LCA Tool Development Procedure

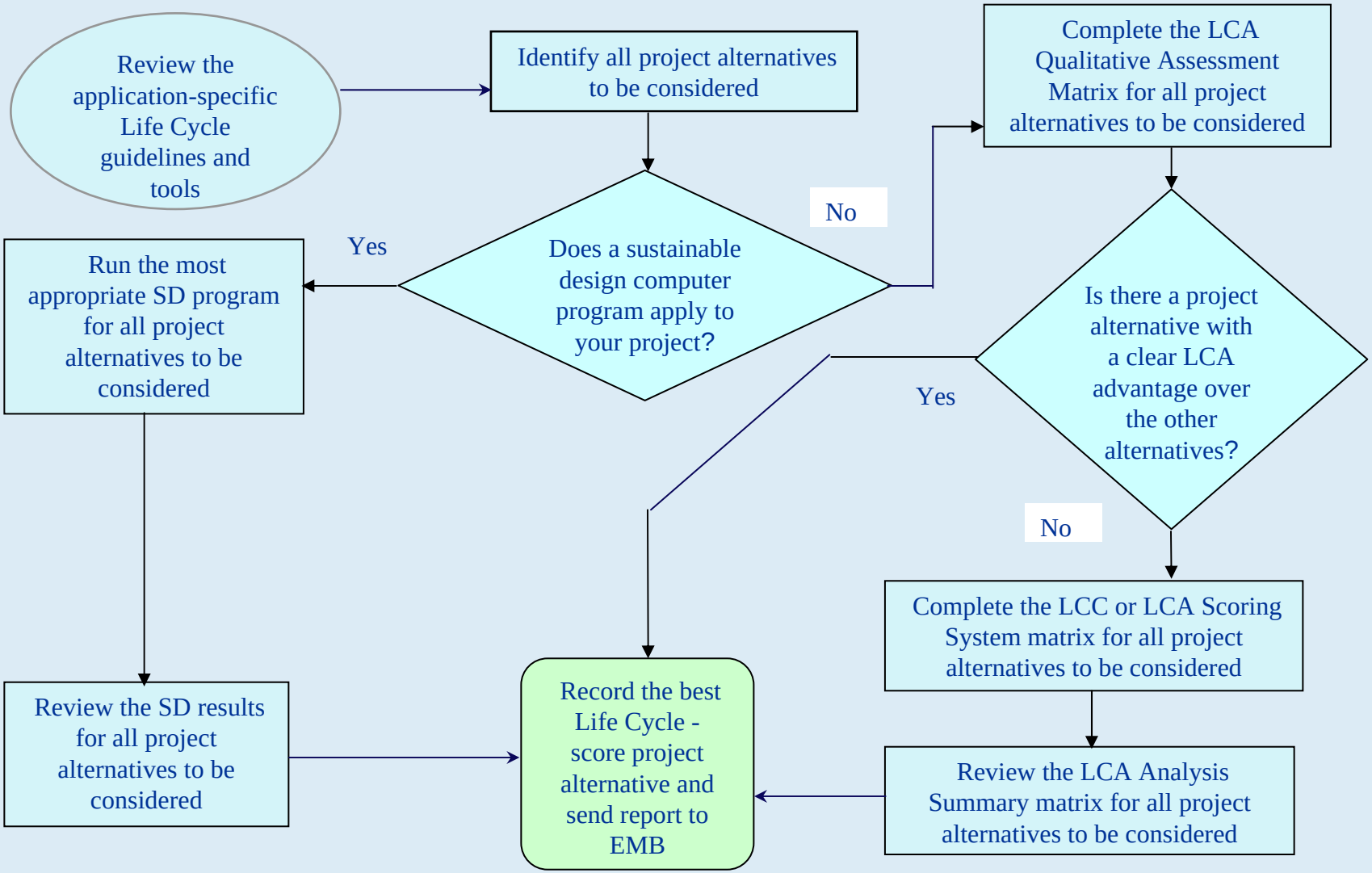


Life-Cycle Assessment Issues to be Resolved

Sample LCA Category

Issue	Yes	No
•Have the relevant & applicable life-cycle stages been identified ?	X	
•Are data sources available to describe the inputs & outputs for these stages?	X	
•Is the available data of an acceptable type & quality to meet the LCA objectives ?	X	
•Have the qualitative LCA issues been identified for inclusion on the Qualitative LCC matrix ?	X	
•Can the qualitative LCC issues been identified, can the LCC matrix be used effectively as a decision-making tool ?		X
•Have the qualitative & quantitative LCA issues been identified for inclusion on the mixed LCA Scoring system matrix ?	X	
•Does the LCA Summary reflect both the qualitative and quantitative issues ?	X	
•Can the LCA Summary Matrix be used effectively as a decision-making tool ?	X	

Life Cycle Procedures for Project Evaluators



Qualitative Life-Cycle Assessment Matrix

Sample LCA Category

Issue / Question	Alt. 1 Yes	Alt. 1 No	Alt. 2 Yes	Alt. 2 No
Performance				
•Does the alternative meet all performance criteria ?	X			X
•Is this a "mission critical" project ?	X		X	
Price				
•Does the cost of the alternative meet budget limitations ?	X		X	
•Is this alternative the least-cost alternative for the project ?	X			X

Qualitative Life-Cycle Assessment Matrix

Sample LCA Category

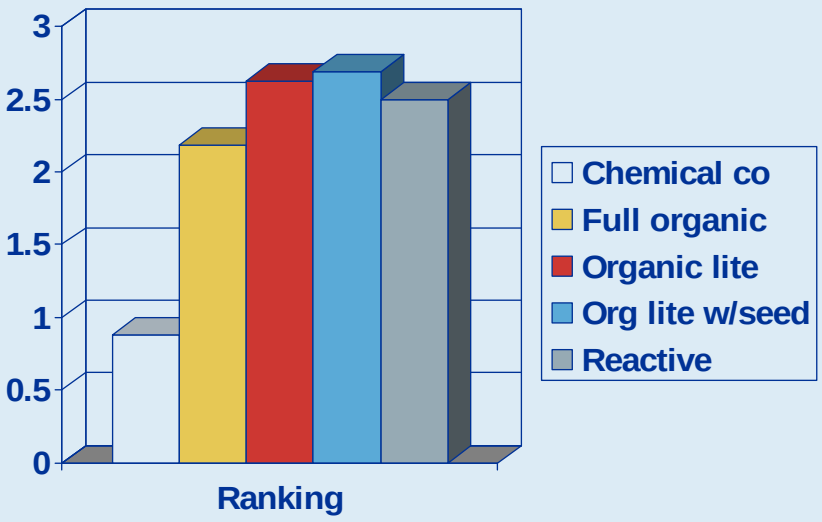
Issue	Question	Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Performance	Does the alternative meet all performance criteria ?										
	Is this a "mission critical" project ?										
Price	Does the cost of the alternative meet budget limitations ?										
	Is this alternative the least-cost alternative for the project ?										
Meeting goals	Is this alternative consistent with the LCA objectives & policies ?										
	Does the alternative minimize the generation of solid wastes ?										
	Does the alternative minimize the generation of hazardous wastes ?										
Material usage	Does the alternative minimize the use of raw materials ?										
	Does the alternative maximize the use of recycled materials ?										
	Does the alternative maximize the use of biobased materials ?										
Resource conservation	Does the alternative minimize the use of water ?										
	Does the alternative minimize the use of energy ?										
	Does the alternative minimize the use of petrochemical fuels ?										
Facility E H & S	Does the alternative minimize the emmissions / releases to air and water ?										
	Does the alternative minimize the health risks to employees ?										
	Does the alternative minimize the safety hazards to employees ?										
Environmental Impacts	Does the alternative minimize the risks of toxic materials to the environment ?										
	Does the alternative minimize the use of materials that can bioaccumulate in environment ?										
	Does the alternative minimize the potential global environmental impacts ?										
Compliance issues	Does the alternative minimize regulatory concerns ?										
	Does the alternative minimize legal liabilities ?										
	Is the alternative consistent with all NASA GRC policies and procedures ?										

Qualitative Life-Cycle Assessment Matrix

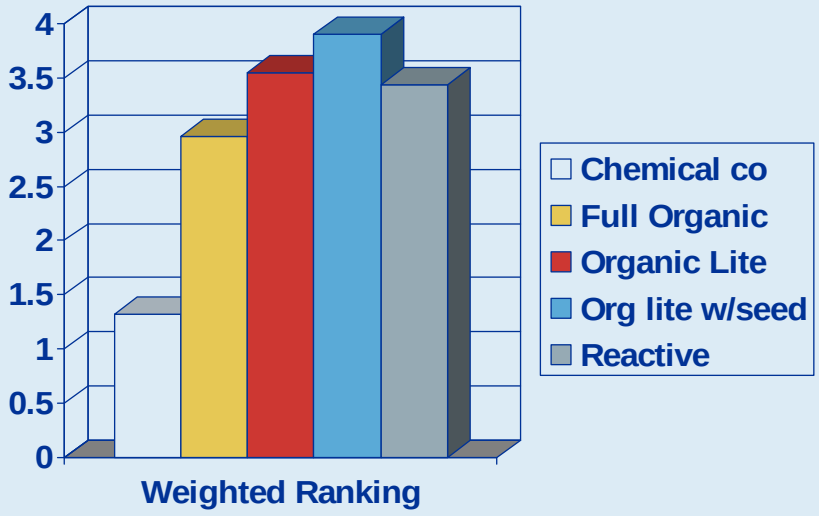
	CHEMICAL LAWN CARE	FULL ORGANIC	ORGANIC LIGHT	ORGANIC LIGHT W/ OVERSEED'G	REACTIVE
Does the alternative minimize the generation of **solid wastes**?	No. Spraying every inch all season.	Overkill, so more than needed, but not as much as 1	Chemical, organic,reactv. > 5 but < 2	=3, but may help health more quickly. 5 OK?	Least impact? = As needed. Except ferlilzr.
Does the alternative minimize the generation of **hazardous wastes**?	Definitely not. Many carcinogenic.	Definitely. All organic.	Much more than 1. Not as much as 2.	Same as Alt 3.	Similar to 3. Except high amt fertilizer.
Does the alternative minimize the use of **raw materials**?	Complex chem's. Plus packaging and shipping.	Same as 1, except not every inch.	Less than 2.	Less than 2, but add seeding, packaging, ship'g.	Similar to 3. Except high amt fertilizer.
Does the alternative minimize the use of **energy**?	Manufacture of chemicals for every inch lawn.	Same as 1, but less, since not every inch.	Less product than 1 and 2.	Energy for seed, but less overall in long run. So < 3	~ = 3, but more needed to mfg fertlzr.
Does the alternative minimize the use of **fossil fuels**?	Trucks del/use. Complex chem's = more proc'g.	Trucks same as 1 with less use. Less complex.	Same as 2, only less.	Same as 2, but more than 3.	Less travel, since all on-site.
Does the alternative minimize **health risks to employees**?	No. Some may be having reactions.	Very much so. Creating healthy ecosystem.	Same as 2, only less. But still 1 haz.	Same as 3, but stronger lawn may reduce chemicals.	Probably same as 3.

Life Cycle Assessment Tool - Lawn care summary

This graph ranks the lawn care practices from 1-3, with “3” ranking the highest.



This graph ranks the lawn care practices from 1-4, with “4” ranking the highest.



RE-DO with floor covering, if done

Quantitative Life-Cycle Costing Matrix

Sample LCA Category (Inputs)

			LC Stage 1		LC S 2	LCC
Process steps	**units**	**# of units**	**$ / unit**	**LCS $**	**…….**	**$**
Raw Materials						
Energy Usage						
• Electricity	kW-hr	200,000	.0001	20		90
• Natural Gas	cubic ft	5,000	.002	100		800
• Deisel fuel	gal	20,000	1.0	20,000		75,000
Water Usage	gal	10,000	.001	10		100
Other Inputs						

Quantitative Life-Cycle Costing Matrix

Sample LCA Category

Life Cycle Cost Elements	Unit Cost	Direct Purchase		Handling and Transportation		Cost of Using the Product		Cost of Waste Minimization		Treatment and Disposal Cost		Training and Management		Potential Liabilities		Record Keeping		Replacement Costs		Life Cycle Cost
	$/unit	units	$	units	$	units	$	units	$	units	$	units	$	units	$	units	$	units	$	$
PROCESS STEPS																				$0
INPUTS			$0		$0		$0		$0		$0		$0		$0		$0		[illegible]	[illegible]
Raw Materials (units)			$0		$0		$0		$0		$0		$0		$0		[illegible]		[illegible]	[illegible]
			$0		$0		$0		$0		$0		$0		$0		[illegible]		[illegible]	$0
			$0		$0		$0		$0		$0		$0		[illegible]		[illegible]		[illegible]	[illegible]
			$0		$0		$0		$0		$0		$0		[illegible]		$0		[illegible]	[illegible]
			$0		$0		$0		$0		$0		$0		[illegible]		$0		[illegible]	[illegible]
			$0		$0		$0		$0		$0		[illegible]		[illegible]		$0		$0	[illegible]
			$0		$0		$0		$0		$0		[illegible]		[illegible]		$0		$0	[illegible]
			$0		$0		$0		$0		$0		[illegible]		[illegible]		$0		$0	$0
			$0		$0		$0		$0		$0		[illegible]		[illegible]		$0		$0	$0
Energy Usage			$0		$0		$0		$0		$0		[illegible]		[illegible]		$0		$0	$0
Electricity (kW-hr)			$0		$0		$0		$0		$0		[illegible]		[illegible]		$0		$0	$0
Natural Gas (cubic ft)			$0		$0		$0		$0		$0		[illegible]		[illegible]		$0		$0	$0
Fuel (gal)			$0		$0		$0		$0		$0		$0		[illegible]		$0		$0	$0
			$0		$0		$0		$0		$0		$0		[illegible]		$0		$0	$0
			$0		$0		$0		$0		$0		$0		[illegible]		[illegible]		$0	$0
Water Usage (gal)			$0		$0		$0		$0		$0		$0		$0		[illegible]		[illegible]	$0
Other Inputs (units)			$0		$0		$0		$0		$0		$0		$0		[illegible]		[illegible]	[illegible]
			$0		$0		$0		$0		$0		$0		$0		$0		[illegible]	[illegible]
			$0		$0		$0		$0		$0		$0		$0		$0		$0	[illegible]
			$0		$0		$0		$0		$0		$0		$0		$0		$0	$0
			$0		$0		$0		$0		$0		$0		$0		$0		$0	$0

Life Cycle Cost Elements	Unit Cost	Direct Purchase		Handling and Transportation		Cost of Using the Product		Cost of Waste Minimization		Treatment and Disposal Cost		Training and Management		Potential Liabilities		Record Keeping		Replacement Costs		Life Cycle Cost
	$/unit	units	$	units	$	units	$	units	$	units	$	units	$	units	$	units	$	units	$	$
OUTPUTS			$0		$0		$0		$0		$0		$0		$0		$0		$0	$0
			$0		$0		$0		$0		$0		$0		$0		$0		$0	$0
			$0		$0		$0		$0		$0		$0		$0		$0		$0	$0
			[illegible]		$0		$0		$0		$0		$0		$0		$0		$0	$0
			[illegible]		$0		$0		$0		$0		$0		$0		$0		$0	$0
			[illegible]		[illegible]		$0		$0		$0		$0		$0		$0		$0	$0
			[illegible]		[illegible]		$0		$0		$0		$0		$0		$0		$0	$0
			$0		[illegible]		$0		$0		$0		$0		$0		$0		$0	$0
			$0		[illegible]		$0		$0		$0		$0		$0		$0		$0	$0
			$0		[illegible]		$0		$0		$0		$0		$0		$0		$0	$0
[illegible]ir (units)			$0		[illegible]		$0		$0		$0		$0		$0		$0		$0	$0
			$0		[illegible]		$0		$0		$0		$0		$0		$0		$0	$0
			$0		[illegible]		$0		$0		$0		$0		$0		$0		$0	$0
			$0		[illegible]		$0		$0		$0		$0		$0		$0		$0	$0
			[illegible]		$0		$0		$0		$0		$0		$0		$0		$0	$0
Releases to Wate[illegible] (units)			[illegible]		$0		$0		$0		$0		$0		$0		$0		$0	$0
			[illegible]		$0		$0		$0		$0		$0		$0		$0		$0	$0
			[illegible]		$0		$0		$0		$0		$0		$0		$0		$0	$0
			$0		$0		$0		$0		$0		$0		$0		$0		$0	$0
[illegible]es (units)			$0		$0		$0		$0		$0		$0		$0		$0		$0	$0
			$0		$0		$0		$0		$0		$0		$0		$0		$0	$0
			$0		$0		$0		$0		$0		$0		$0		$0		$0	$0

Quantitative Life-Cycle Software

- SimaPro
- Umberto
- TEAM
- CMLCA
- BEES
- …..

LCA Scoring System: Qualitative/quantitative (mixed) evaluation model

- Combines features of the qualitative model with available quantitative data (LCC), creating a scoring system (0 to 6)
- The scoring system must be both feasible and practical for the particular application
- Relative comparison of alternatives, used to compare the alternatives identified for a specific application
- Uses weighting factors (0 to 1.0) to establish priorities (legal, policy, etc.)
- Multiple-criteria decision-making principles are being incorporated into the process of assigning the weighting factors
- Produces a numerical score for each alternative

LCA Scoring System

***Health risks benefits*:** Health risk factors include the following: Carcinogens, neurotoxins, immunotoxins, reproductive/developmental toxins, other toxins, irritants, sensitization.

OSHA-regulated chemicals will be on a "restricted" list, along with additions made by the IH department. Consideration will be given to potential inhalation, skin contact (including absorption), eye exposure, and ingestion.

The most desirable products in this category would provide the greatest positive impacts in health risks through the use of the product at GRC.

Rating	Potential for health risks impacts
6 =	Large positive impact
5 =	Moderate positive impact
4 =	Small positive impact
3 =	No significant impact
2 =	Small negative impact
1 =	Moderate negative impact
0 =	Large negative impact

LCA Summary Matrix

Sample LCA Category

		Project Alternatives				
Issue	**Relative Ranking Category**	**1**	**2**	**3**	**4**	**5**
Performance	Meets all performance standards					
	Track records support this alternative					
Price	Within budget limitations					
	The least-cost alternative for the project					
	The lowest LCA cost alternative for the project					
Meeting goals	Maximizes the recycle potential					
	Minimizes the generation of solid wastes					
	Minimizes the generation of hazardous wastes					
Material usage	Minimizes the use of raw materials					
	Maximizes the use of recycled materials					
	Maximizes the use of biobased materials					
Resource conservation	Minimize the use of water					
	Minimizes the use of energy					
	Minimizes the use of petrochemical fuels					
Facility E H & S	Minimizes the emmissions / releases to air					
	Minimizes the emmissions / releases to water					
	Minimizes the health risks to employees					
	Minimizes the safety hazards to employees					
Environmental Impacts	Minimizes the risks of toxic materials to the environment					
	Minimizes the use of materials that can bioaccumulate in environment					
	Minimizes the potential global environmental impacts					
Compliance issues	Minimizes regulatory concerns					
	Minimizes legal liabilities					
	Minimizes concerns about GRC policies and procedures					

LCA Scoring System: EPP+ Product Evaluation Model

- A life-cycle based comparison of off-the-shelf products within identified product-use categories (including the use of multiple-criteria decision-making within the determination of weighting factors)
- Determine product-use categories and sub-categories to be included (may be facility or site-specific)
- Identify candidate products for the EPP list evaluation, using screening tools (legal, policy, etc.)
- Meet multiple goals – Affirmative Procurement scores included within the EPP+ lists
- Gather information and score candidate products
- Promote the use of EPP+ lists

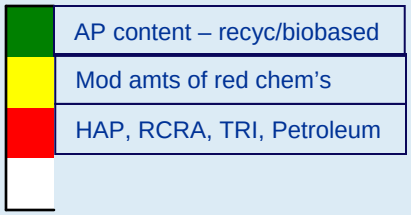
EPP+ Summary Score Sheet for Customers

Heavy-Duty Cleaning / Degreasing

Product	Manufctrer	Score	LL	Affirmative Procure Recycle	Affirmative Procure Biobased
NearPerfect	Fictional	91.0	Y	5	5
Useit	Wetryhard	61.4	Y	0	2
Maybe	Notoobad	50.8	N	3	0

EPP+ Summary Score Sheet for Customers
Heavy-Duty Cleaning / Degreasing

	Performance			Relative Costs			
Product..	**Appl**	**Rcrd**	**Sc**	**Capital**	**O & M**	**Pybk**	**Sc**
NearPerfect	5	5	7.0	5	5	5	12.0
Useit	3	2	3.4	5	5	5	12.0
Maybe	5	4	6.2	4	3	4	8.8
Wt. Factors	0.6	0.8		0.8	0.8	0.8	



EPP Scoring System

Manufacturer	Affirm Procure: Recycled content	Affirm Procure: Biobased		Product	Total Weighted Score	Life Cycle Score	Performance	Price
Lyondell		Y	TRI/Petrol	N-methyl pyrrolidone	44	34	4	6
Petroferm, Inc.		Y	Petroleum	BIOACT 113	38	31	2	6
7th Generation				Citra-Fresh Clnr & Degr	52	42	1	8
Ecolink Inc.				QED Envir. Pref. Solvent	43	34	4	5
Ecolink Inc.			Petroleum	New II	45	36	4	6
Ecolink Inc.		Y	Petroleum	Vortex	50	42	4	5
Florida Chemical		Y	RCRA-flam	d-Limonene	53	43	4	6
Krud Kutter				Krud Kutter-Original	34	28	1	5
Enviro-Magic			HAP&TRI	T-Pole-Plus concentrate	50	41	1	8
GSA Env'l Prod Gd			HAP&CER	Simple Green cleaner/deg	52	40	4	8
GSA Env'l Prod Gd			HAP	Crystal Simple Grn clean/deg	52	40	4	8
EnviroSan Products			HAP	Solution 2000	0	0	0	0

Meeting basic P2 Goals
- Recycle potential
- Solid waste min
- Haz waste min

Resource Cons
- Water use reduc
- Energy use red
- Other res reduc

Facility SHE
- Emissions
- Health risk
- Safety hazard

Global impacts
- Bioaccumulation
- Land,air,water
- Global warming

LCA Scoring System

NASA Glenn Research Center

Scoring Methodology for Environmentally Preferable Purchasing Plus

EPP+ SCORING SUMMARY

Cleaning Products: General Cleaning Products

					Product Life Cycle Factors																													
			AP		Performance				Price				Meeting Goals				Conservation				Facility EH&S				Env Impact-Potential				Compliance					
Product	**Manufacturer**	**Total Score**	recycled content	biobased product	applicability	perfomance record	impact on mission	Score	capital costs	O &M costs	payback period	Score	recycle potential	solid waste min.	haz. waste min.	Score	water use reduction	energy use reduction	other resources reduction	Score	envir. emissions	health risk benefit	safety haz. benefit	Score	Bioaccumulation	Env. Damage (local)	Global issues (GW, etc)	Score	regulatory benefit	EO & policy benefit	reduces liabilities	Score		
Chemical ABC	all manufacturers	61.4	0	1	3	2	4	5.4	5	5	5	12.0	4	1	5	10.0	1	1	1	1.8	5	4	4	10.4	5	4	4	10.4	4	5	4	10.4		
Product DEF	Company XYZ	56.8	2	0	5	4	4	7.8	4	3	4	8.8	4	4	2	10.0	1	4	2	4.2	4	3	3	8.0	5	3	4	9.6	2	2	4	6.4		
Product Perfect	Fictional	91.0	5	5	5	5	5	9.0	5	5	5	12.0	5	5	5	15.0	5	5	5	9.0	5	5	5	12.0	5	5	5	12.0	5	5	5	12.0		
		0.0						0.0				0.0				0.0				0.0				0.0				0.0				0.0		
	weighting factors:				0.6	0.6	0.6		0.8	0.8	0.8		1	1	1		0.6	0.6	0.6		0.8	0.8	0.8		0.8	0.8	0.8		0.8	0.8	0.8			

EPP+ Product-Use Categories

- Cleaners
  - Cleaner - light duty **(AP)**
  - Contact cleaner
  - Defluxer
  - Degreaser - heavy duty **(AP)**
  - Toilet bowl cleaner
  - Glass cleaner **(AP)**
- Paints, coatings, adhesives
  - Adhesive
  - Adhesive remover **(AP)**
  - Contact adhesive **(AP)**
  - Gasket remover
  - Paint/coating removal
  - Paint touchup-aircraft
- Machining fluids
  - Cooling fluid **(AP)**
  - Cutting fluid **(AP)**
  - Layout fluid **(AP)**
  - Lubricating **(AP)**
  - Marking dye **(AP)**
  - Tapping oil **(AP)**
- Automotive products
  - Air filter
  - Bolt loosener
  - Brake cleaner
  - Degreaser-HD
  - Gasket remover
  - Tire bead sealer
  - Tire repair
  - Parts washing
- Facilities and maintenance
  - Backup power LCA
  - Sorbents **(AP)**
  - Floor covering LCA
  - **Lawn and grounds**
    - Fertilizer **(AP)**
    - Herbicide
    - Lawncare service LCA
    - Road deicer LCA
  - **Cafeteria**
    - Containers, plates, utensils **(AP)**
    - Biodegradable films **(AP)**
  - **Janitorial**
    - Wax removal
- Office
  - Awards **(AP)**
- Home and personal care
  - Deodorant
  - Light bulbs LCA
  - Paint/coating removal
  - Toilet bowl cleaner
  - Toilet paper **(AP)**

CNSST Projects / Requests

Projects – to share results / lessons learned:
- Cafeteria – reductions / replacements
- Janitorial – replacements / suggestions
- Groundskeeping

EPP products / categories – on website:
(biobased – but will find/rate as EPP:)
- glass cleaner
- hand cleaner / sanitizer
- fertilizer
- lip care products
- films for cafeteria

- requests for NASA-wide ?

Life Cycle Assessments – on website:
- flywheel backup power
- lawn care
- light bulbs
- road salt
- floor covering

- requests for NASA-wide ?

Sustainability efforts at GRC

CSU/NASA Sustainability Support Team

Sam Higuchi (HQ), Lead

Dan White (COTR), GRC Lead

Services provided: GRC / Pilots

- Environmental Accounting
- Life Cycle Assessments: Services / Tools
- EPP+: Product Evaluations / Listings
- Energy & Water Conservation / Power
- Natural Resources Protection Support
- Training and Outreach
- New GRC P2 projects, support for current
- Other services – as designated by HQ

P2/Sustainability Committee

Dan Papcke, Lead → Michelle Kenzig, Lead

- Recycling
- AP (recycled-content)
  - Language into contracts
  - Train buyers
- NETS, other: Enter P2, AP, Recycling data
- New P2 projects not covered by other avenues
- Training & Outreach

GRC Clean Team

Sandy Valenti (SAIC) and Luz Jeziorowski, Leads

- Indoor Environmental Quality
  (Joint effort: Facilities, Logistics, SHED)

GRC Energy & Water Conservation Network

Henry Wroblewski, Lead

- Energy conservation
- Alternative power generation
  - Wind, solar, geothermal, hydrogen, methane, etc.
- Community collaborations
- Water conservation
- Outreach and education

Sustainability efforts at GRC

Friends of Sustainability
Rick Danks and Joe Morris, Leads

- Green Building
- Outreach / Training / Conferences

Earth Day Committee
Dave Forth (SAIC), Lead

- Earth Day events
- GRC and community outreach

AeroSpace Bus
Dan White, Lead

- Traveling environmental exhibit
- Movies

GO-BIKE
Fred Oswald, Lead

- Bike-to-Work
- Mass transit
- Bicycle and safety training

Adopt-A-Highway
Fred Kohl, Lead

- Trash pick-up on I-480

(Research)
Peter Tschen, Lead

- Biomimicry training

Natural Resources / Endangered Species
Rich Kalynchuk, Lead

- Emerald ash borer issue
- Identification/protection of species/habitats

Partnerships / Community Collaborations
Joe Shaw, Lead

- Tours and conferences for the community
- Partnerships for projects

Speakers Bureau
Cheryl McCallum, Lead

- Sustainability speaker scheduling
- Renewable energy events

Other spontaneous projects:

- Stormwater pollution
- Cigarette butt pickup
- Other research areas / organizations

Partnerships / Community Collaborations

- Alternative power/resource input
- Community collaborations support
- Events and tours – Solar Tour 2007

Natural Resources / Endangered Species

- Emerald ash borer issue support
- Identification/protection of species/habitats

CSU / NASA Sustainability Support Team

Core services: EPP, LCA, pilot projects, interface/assist

(Research)

- Biomimicry outreach support

Energy & Water Conservation Network

- Website development and updates
- Energy and water conservation outreach
- Alternative power generation support
- Community collaborations support
  - Hydrogen station at GLSC
- Outreach and education

P2/Sustainability Committee

- Project success reports
- Weekly highlights
- Training and outreach
- New P2 opportunities
- Website development and updates

GRC Clean Team

- Road de-icing advising / LCA
- Floor covering advising / LCA
- Cafeteria products/procedures
- Janitorial review/suggest products
- Groundskeeping products/procedures

Friends of Sustainability

- Life Cycle services/tools
- Planning/outreach support
- LEEDs outreach

Other spontaneous projects:

- Cigarette butt pickup
- Stormwater: Adopt-A-Drain
- Other research areas

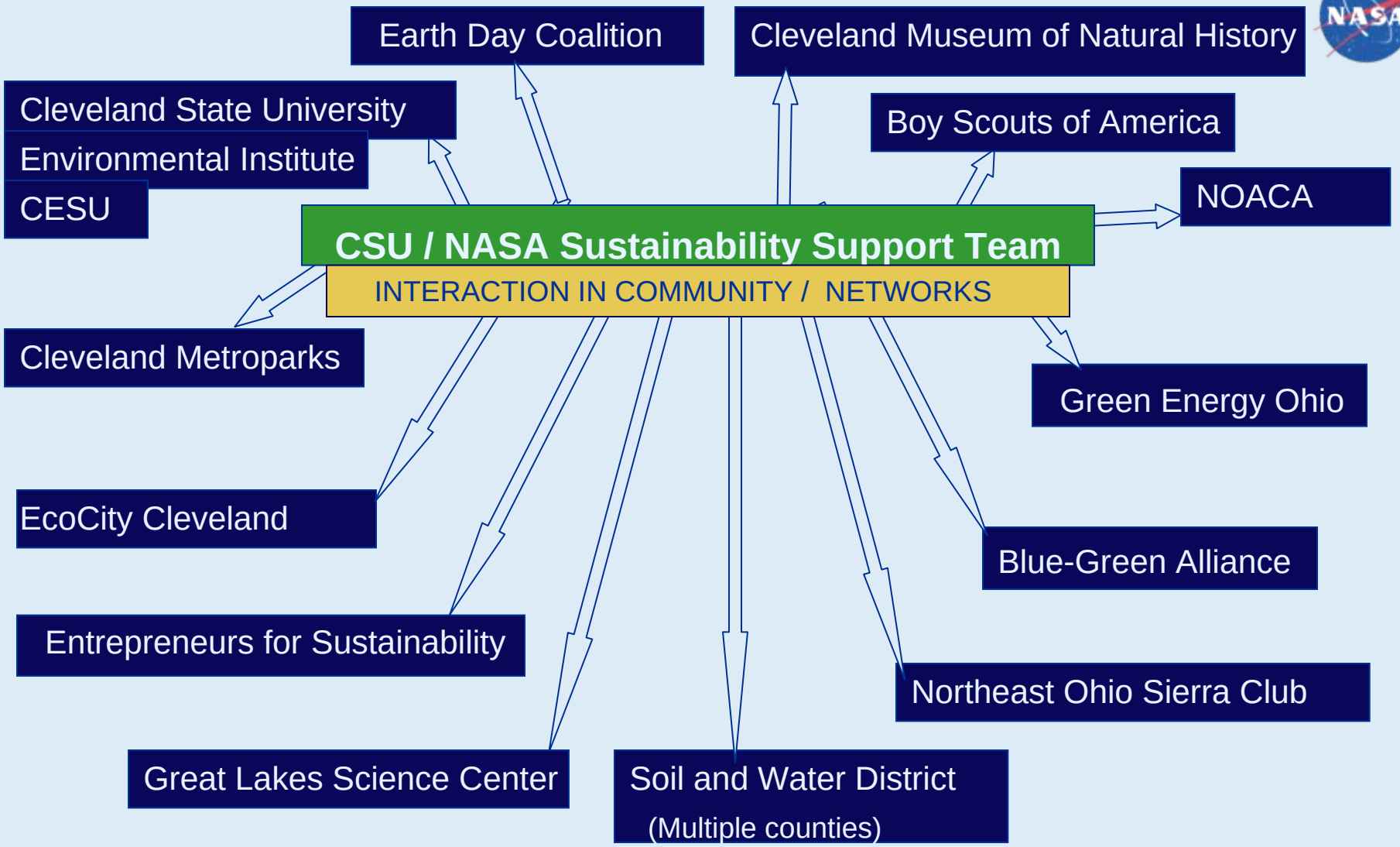
GO-BIKE

Adopt-A-Highway

Speakers Bureau

Earth Day Committee

AeroSpace Bus


Earth Day Coalition
Cleveland Museum of Natural History
Cleveland State University
Environmental Institute
CESU
Boy Scouts of America
NOACA
CSU / NASA Sustainability Support Team
INTERACTION IN COMMUNITY / NETWORKS
Cleveland Metroparks
Green Energy Ohio
EcoCity Cleveland
Blue-Green Alliance
Entrepreneurs for Sustainability
Northeast Ohio Sierra Club
Great Lakes Science Center
Soil and Water District
(Multiple counties)

CNSST Contributions to P2 Reporting

2007- Projects in Progress
Environmental Cost Accounting
Adopt-A-Building lawn care
Road salt replacement LCA
Floor covering LCA
Cafeteria supply reductions/replacements
Janitorial supply evaluation/suggestions
Add products to EPP website
Real Time Monitoring System
Hydrogen power production/station
Portable hydrogen unit

2006 Completed Projects
Flowable Fill Guidelines
Energy Conservation Awareness Program
Water Conservation Awareness Program
P2/Sustainability course at Cleveland State University
AP/EPP Training Session at PBS (Slides for Bob Lallier)
Plant a native prairie (Research/assistance to Aaron Walker)

2005 Completed Projects
Recycled content paper towels
Spark plug efficiency study
Life Cycle Assessment - lawn care & light bulbs
Garnet abrasive recycling system
Environmental Technology course at CSU
CFL light bulb pilot program

2004 Completed Projects
Contact cleaner replacement
Icing Research Tunnel boot adhesive remover
Machine Shop chemical replacements
P2/Sustainability Website
Flywheel power supply